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Social Indicators and Productivity Convergence in Developing Countries

Gregory Ingram

If the goal of economic development is to promote human welfare, the most efficient focus of development efforts is in very low-income developing countries. There the payoff in improved social indicators that measure human welfare is higher than it would be for similar efforts in middle-income countries.

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This paper — a product of the Research Advisory Staff, Office of the Vice President, Development Economics — was prepared for the Conference on Historical Perspectives on the International Convergence of Productivity held in April 1992. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Jean Gray Ponchamni, room S3-033, extension 31022 (April 1992, 40 pages, including tables).

Most analysis of the convergence of productivity addresses industrial countries. Ingram takes a broader approach to measures of performance.

For one thing, he analyzes some measures of productivity but focuses far more on social indicators that are not narrowly economic, including:

- Indices of outcome, such as life expectancy.
- Indices of the availability of inputs, such as doctors per capita.
- Indices that can be either inputs or outcomes, such as per capita caloric intake of food.
- Measures of government spending patterns.

Moreover, he examines a large universe of countries: 21 high-income or industrial countries and up to 88 developing countries (depending on the availability of data). Some data cover the entire period, 1960-85; some cover only a few years in that period.

According to Ingram, gaps in per capita GDP have increased among low-, middle-, and high-income countries. The range of per capita GDP growth rates in developing countries has widened as well.

Ingram finds that evidence does not indicate a convergence of productivity levels across the sample of countries. Differences in absolute levels of productivity are increasing, not decreasing — among the developing countries, and between developing and industrial countries.

There is some convergence in average productivity growth rates between developing and industrial countries, but modest disaggregation by income level and region reveals a divergence in growth rates among developing country groups and between those groups and high-income countries.

However, the evidence shows strong convergence across the sample for several social indicators that are good measures of human welfare. Four social indicators — life expectancy, caloric intake, primary enrollment ratios, and urbanization — show evidence of convergence for every convergence index used. Two social indicators — labor force participation rates and defense spending as a share of GNP — show no evidence of convergence by any index used. The other 10 social indicators show some evidence of convergence; social spending as a percentage of GNP is the next most convergent of the remaining indicators.

Social indicator levels are often closely related to GDP levels, but other factors are also clearly at work, including the transmission of knowledge, information, and new technologies across national borders.

Ingram's main conclusion: a given absolute or proportional increase in per capita GDP in very low-income developing countries is generally associated with greater improvements in the social indicators that measure human welfare than is a similar increase in middle-income developing countries.

To the extent that improving welfare is the objective of development efforts, it is most efficient to focus such efforts on low-income developing countries.

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by
Gregory Ingram*

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Most of the analysis of convergence of productivity addresses some aspect of it in industrialized countries. The approach here is broader in two respects. First, although some information is presented on productivity measures, much of the data analyzed here deals with other measures of performance which will be referred to collectively as social indicators. These indicators are not narrowly economic and include indices of outcomes, such as life expectancy; indices of the availability of inputs, such as doctors per capita; indices which could be labelled as inputs or outcomes, such as per capita caloric intake of food; and measures of government expenditure patterns. Second, the universe of countries examined is large and includes 21 high income or industrialized countries and up to 88 developing countries, depending on the availability of data for particular variables and time periods. The years covered for each variable fall within the period, 1960 to 1985, with a few variables covering virtually the whole interval and some others available for only a few years within this period.

To briefly summarize the results of the analysis, the evidence does not indicate that there is convergence in productivity levels across the sample of countries analyzed. Differences in absolute levels of productivity are increasing and not decreasing. This is true within the group of developing countries and between developing and industrial countries. There is some convergence in average productivity growth rates between developing and industrial countries, but modest disaggregation by income level and region reveals a divergence in growth rates

among developing country groups and between these groups and high income countries.

The evidence does indicate that there is strong convergence across the sample for several social indicators that are good measures of human welfare. Some other social indicators, however, show little evidence of convergence and their levels increase linearly (or more than linearly) with GDP per capita measures. And still other indicators show moderate degrees of convergence.

One basic conclusion from this analysis is that a given absolute or proportional increase in per capita GDP in very low income developing countries is generally associated with greater improvements in the social indicators that measure human welfare than a similar increase in per capita GDP in middle income developing countries. To the extent that improving welfare is the objective of development efforts, it is efficient to focus such efforts on low income developing countries.

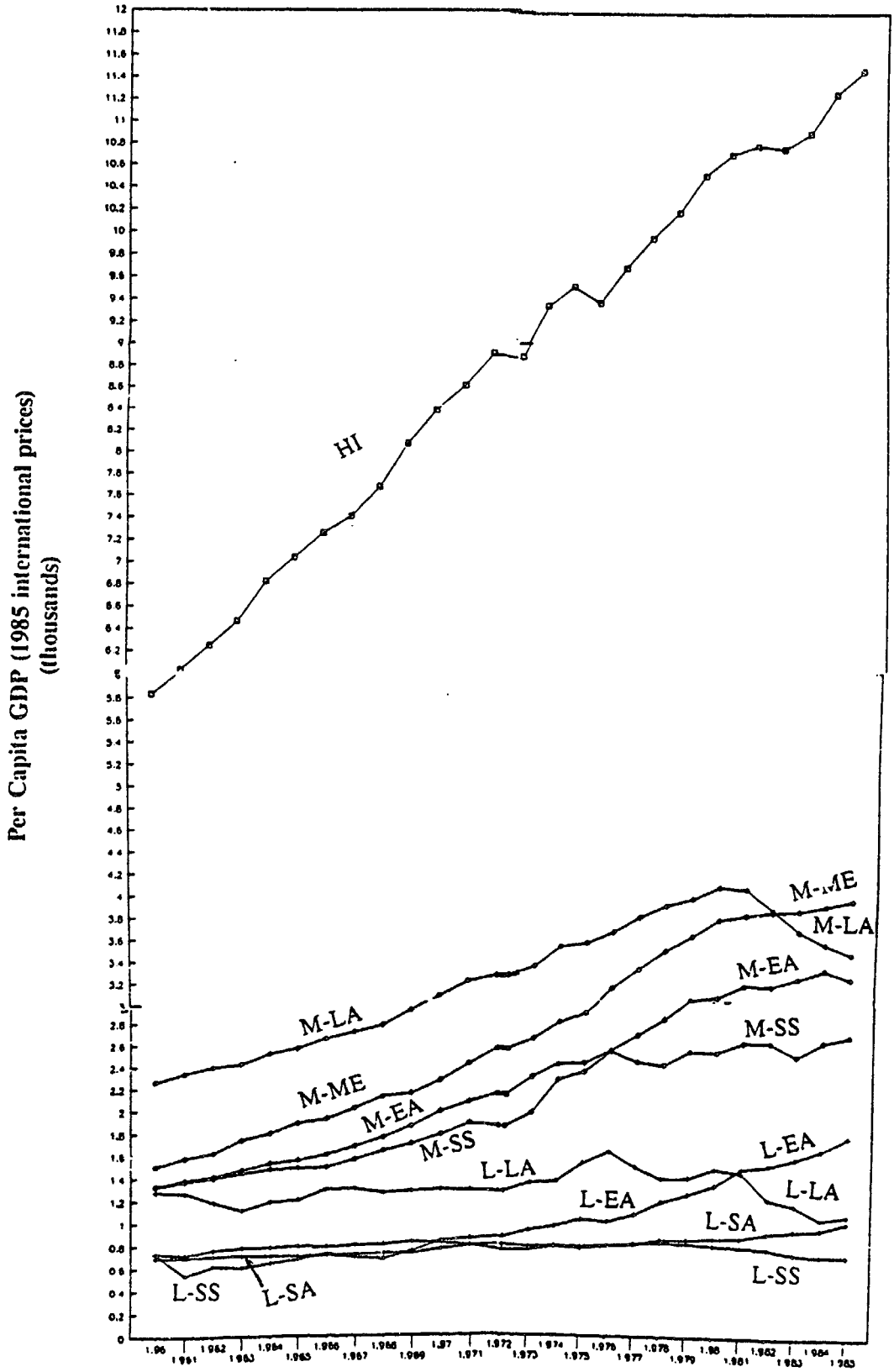
PRODUCTIVITY MEASURES

There are many possible measures of economic performance, and a good survey is provided by Usher (Reference 7). Because it has been widely used in similar studies, the measure of productivity used here is the Heston-Summers purchasing power parity per capita GDP measured in constant 1985 prices. The data are taken from the World Bank Economic and Social Data Base and are available since 1960 for 21 high income or industrial countries and 88 developing countries. To facilitate analysis,

the 21 high income countries have been placed in one group (HI), and the 88 developing countries have been grouped by income level--low income (L) or middle income (M). At times the developing countries are also disaggregated by five regions of location: Mediterranean and Middle East (ME), South Asia (SA), East Asia (EA), Latin America (LA), and Sub-Saharan Africa (SS). This produces one high income and eight developing country groups because there are no middle income South Asia countries and only one low income country in the Middle East region. The income and regional country groupings are displayed in Annex 1 which shows GDP per capita in 1985 dollars for various years for each country. The income and regional groupings are those used by the World Bank and are described in the 1991 World Development Report (reference 9) and the World Tables (reference 10). This sample includes 35 low income and 53 middle income countries. The region and income group are invariant for each country.

Figure 1 shows the average level of GDP per capita for the nine groups by year from 1960 to 1987. The disparity between the highest and lowest income groups in 1987 is approximately twenty-fold ($600 to $12,000), a doubling of the ten-fold ($600 to $6000) disparity observed in 1960. This doubling in range occurs because the per capita GDP of the poorest developing country groups have remained roughly constant while the per capita GDP of high income countries has doubled over this period. All of the middle income developing country groups have grown during the period, although not continuously, and the best performances are

Figure 1: GDP Per Capita: 1960-1985



displayed by the Middle East, South Asia, and East Asia regions. Among low income groups, East Asia is the fastest growing region, South Asia has the lowest levels, and Sub Sahara Africa has stagnated.

In absolute terms, Figure 1 suggests there has been divergence rather than convergence in per capita GDP across these groups over time. For developing countries the range of GDP per capita widens within both the medium and low income groupings, as well as between them. Rather than rely on visual evidence from Figure 1, the coefficient of variation (a sample's standard deviation as a percentage of the sample's mean) is used as a statistic to measure convergence. A reduction (increase) in the coefficient of variation indicates less (more) variation in performance or an increase (decrease) in homogeneity.

Table 1 shows the coefficient of variation and mean of GDP per capita for various years and country groupings. The coefficients of variation in Table 1 indicate that per capita GDP levels have neither converged nor diverged over time for all countries taken together. Convergence over time is evident for high income countries and for middle income developing countries, but not for low income developing countries. GDP per capita for all developing countries taken together has diverged somewhat over time. The mean values of GDP per capita in Table 1 indicate that both high income and middle income countries have doubled their average GDP per capita from 1960 to 1985, while low income countries have increased their average by a fifth. In absolute

Table 1
GDP Per Capita--Country Groups, Various Years

Year	Country Grouping: All	Developing Countries: All	Developing Countries: Low	Developing Countries: Middle	High Income
	Coefficient of Variation				
1960	95.	68.	45.	54.	32.
1970	97.	72.	44.	51.	24.
1980	93.	78.	43.	52.	20.
1985	97.	72.	45.	45.	21.
	Mean Value				
1960	2260	1350	730	1770	5830
1970	3090	1800	820	2470	8370
1980	4070	2490	890	3540	10730
1985	4150	2400	870	3420	11500

terms, gaps between these three income groups have widened. In relative terms, middle income countries have nearly kept pace with high income countries while low income countries have not. Figure 1 and Table 1 taken together offer some evidence for the view that developing countries are separating into two groups: one that is growing and maintaining or increasing its involvement with the world's economy, and a second that is stagnating and becoming progressively marginalized. The heterogeneity of developing countries appears to be increasing over the period shown.

Table 2 shows for each regional and income level grouping the average growth rates of per capita GDP over the 1960-85 period and for each decade. It complements Figure 1 and Table 1 which convey information on per capita GDP levels rather than

Table 2
Average Growth in per capita GDP

Country Grouping (Income/Region)	Time Period 1960-69	1970-79	1980-85	1960-85
High	3.9	2.5	1.3	2.9
All Middle Income	3.4	3.7	-0.6	3.2
M/East Asia	4.2	4.3	1.0	4.0
M/Latin America	2.9	2.7	-2.8	2.2
M/Medit. & Mid. East	4.4	5.2	1.3	4.3
M/Sub Sahara Africa	2 5	3.6	1.0	3.2
All Low Income	1.3	0.9	-0.8	0.9
L/East Asia	-2.7	3.3	7.5	3.7
L/Latin America	0.4	1.6	-6.3	0.3
L/South Asia	1.6	1.0	2.7	1.0
L/Sub Sahara Africa	1.3	0.7	-1.6	0.8

growth rates. On a decadal basis, economic growth has slowed from the sixties to the eighties for high income countries. For developing countries, the picture is more complicated. Except for Latin America, middle income developing country groups grew faster in the seventies than in the sixties or the eighties, and the eighties were particularly bad for Latin America and low income Sub Saharan Africa. The eighties were not, however, a "lost decade" for the low income East and South Asia country groups which experienced their highest decadal growth then. There is some regional homogeneity, both in terms of bad performance (Sub Sahara Africa, Latin America) and good performance (East Asia). These patterns are similar to those presented in Morawetz (Reference 6) which are based on different economic performance measures and an overlapping but earlier period. Regressions of decadal growth rates on decade-starting

GDP per capita, shown in Annex 2, yield no relation between the two. Growth is not random, however, and economic policy variables are strongly related to growth rates (reference 4)

Table 3, which shows the coefficient of variation of growth rates, reveals no tendency for growth rates to converge for developing countries over time. Within each income group, the variation in country group growth rates increased over time. For each period shown, the coefficient of variation falls from low income to high income groups, indicating an increase in the homogeneity of growth rates across income groups.

Table 3
Coefficient of Variation--Growth Rates

	Country Grouping				
		Developing Countries			High
Period	All	All	Low	Middle	Income
60-69	80.	91.	188.	53.	41.
70-79	107.	118.	302.	73.	43.
80-85	1320.	556.	551.	544.	80.
60-85	78.	89.	170.	56.	31.

The 1961 to 1985 average growth rate of per capita GDP for all developing countries taken together is 2.2 percent, compared to 2.9 percent for high income countries. Both of these growth rates are quite respectable when compared to the long term historical growth rates experienced by the currently high income countries. For example, Kuznets (reference 5) estimated that per capita GDP grew in the U.S. at 1.6 percent per annum from 1839 to 1961. There is little comfort in this comparison, however, for low income developing countries when taken as a group.

be more likely to be closely associated with convergence of GDP levels.

Sixteen social indicators drawn from the World Bank Economic and Social Data Base and described in Social Indicators of Development (reference 8) are analyzed and reported on in this section, and they range from those involving few tradables (but probably much technological information) to those which are essentially per capita measures of tradables. The main issue addressed is the extent to which these indicators exhibit convergence in the sample of countries for which data are available. A secondary issue is the extent to which convergence occurs at low levels of GDP per capita. The comparators for the social indicators are the convergence patterns of GDP levels and growth rates.

Three measures of convergence are used here. The first, a measure of bounded convergence, is based on the relation between the social indicator and per capita GDP across countries in a particular year. If the social indicator approaches an asymptote as GDP per capita increases, it is a converging indicator. Data are often available for several years in the 1960-88 period, such as years of census enumeration, and the elasticity of the social indicator with respect to per capita GDP is obtained by regressing the social indicator on per capita GDP across all countries in the sample in a given year. If the elasticity exceeds one, the indicator is growing faster than GDP and is diverging; if the elasticity is less than one, the indicator is

SOCIAL INDICATORS

The preceding section provides little evidence of convergence of GDP growth and levels among developing countries or between developing and developed countries. Convergence of GDP levels seems to be occurring mainly among high income and middle income countries, and growth rates have been diverging over time for all income groups. The more extensive analysis of growth in developing countries reported in Blomstrom, et al., (reference 2) finds little evidence of gross convergence of GDP growth. GDP per capita is not, however, the only performance measure available for a country. Numerous social indicators have been developed to measure welfare outcomes across countries. Analysts are beginning to use social indicators to supplement economic measures when analyzing the impact of policy measures (for an example, see Behrman and Deolalikar, reference 1).

The hypothesis that GDP growth and levels should converge is based on common access to technology and knowledge in a world where international trade and information flows are pervasive. This argument has been put forward by many authors and is elaborated in Grossman and Helpman (reference 3). This same logic of convergence can be applied to many other measures of a country's performance, such as health outcomes or educational attainment. For those performance measures that are mainly the product of non-traded inputs, convergence of outcomes could occur at fairly low GDP levels. For performance measures that are based heavily on tradable inputs, convergence of outcomes would

converging. An elasticity of zero indicates no variation of the indicator with per capita GDP and can imply strong convergence or no relation. Negative elasticities also generally indicate convergence. This measure does not capture all possible types of convergence, but it does work well with most of the indicators examined here. Elasticity estimates are presented in tables in the sections which follow. Representative plots of each social indicator against GDP per Capita and all regression results are contained in Annex 3.

The second measure compares the coefficient of variation of the social indicator for different groups of countries over time, as was done in Tables 1 and 3 above for GDP based measures. This measure of variance reduction or homogenization is estimated for each of the three country income groups (high, medium, and low income) for various years with available data. Convergence is indicated when the coefficient of variation declines over time for a particular country group.

The third measure of convergence is based on the disparity in mean values of the social indicators over time across country income groups. A reduction in this disparity indicates that developing countries are "catching up" with high income countries by closing the gap. The disparity can be measured in absolute or proportional terms.

Demographic Indicators

Four demographic indicators are presented in this section: life expectancy; crude birth rate per thousand; age-dependency ratio (0-15 & 65+ vs. 15-65); and the female/male ratio. The summary statistics are shown in Table 4. Convergence is quite marked for life expectancy. The low elasticity indicates bounded convergence (evident in the Annex 3 graph), and the coefficient of variation declines over time for most years. Moreover, both the absolute and relative gap in life expectancy has decreased across low, middle, and high income groups. This is an indicator which is improving for all income groups over time, and particularly for developing countries.

Table 4
Demographic Indicators

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Life Expectancy					
1960	103	0.21	41.3	54.1	69.4	15.	17.	2.
1970	107	0.18	45.7	58.6	72.0	14.	14.	2.
1980	108	0.16	49.5	62.7	74.4	13.	12.	2.
1985	108	0.15	51.6	64.5	75.5	13.	16.	2.
			Birth Rate per Thousand					
1970	106	-0.38	45.8	36.8	17.0	13.	29.	16.
1980	107	-0.41	44.5	33.1	13.9	17.	31.	21.
1985	107	-0.44	43.8	31.3	12.9	19.	34.	17.
			Age Dependency Ratio					
1960	90	-0.14	0.86	0.85	0.59	9.	16.	14.
1970	100	-0.16	0.89	0.87	0.59	9.	19.	11.
1980	101	-0.19	0.89	0.79	0.54	13.	21.	10.
1985	108	-0.21	0.89	0.77	0.51	14.	22.	11.
			Female/Male Ratio					
1960	102	-0.00	1.02	1.01	1.03	5.	6.	4.
1970	105	0.00	1.02	1.01	1.03	4.	5.	4.
1980	106	0.01	1.02	1.01	1.04	4.	4.	3.
1985	106	0.01	1.01	1.01	1.04	4.	4.	4.

Birth rates and the age-dependency ratio show patterns similar to each other and are not nearly as convergent as life expectancy. Both are inelastic, indicating bounded convergence, and both show a reduction in the absolute gap between middle and high income country groups. But for both, the coefficient of variation increases over time, and there is no relative gap reduction. There is essentially no association between the female/male ratio and per capita GDP, which is surprising given the longer life expectancy of females in high income economies. The only indication of convergence is the slight reduction in the coefficient of variation over time. Several low income countries have high ratios of females to males, probably due to the effects of selective migration.

The sharp convergence in life expectancy observed in Table 4 largely results from a sharp reduction in infant and child mortality thought to be caused by a combination of medical and infrastructure factors such as inoculation, oral rehydration therapy, and the provision of potable water and rudimentary waste disposal facilities. That is, the improvement results from a combination of internationally available information and the use of non tradable inputs.

Health Indicators

The health indicators are the average daily caloric intake of food per capita, the number of hospitals per capita, and the number of doctors per capita; summary statistics are shown in Table 5. Daily caloric intake is inelastic with respect to per

capita GDP and exhibits bounded convergence. The coefficient of variation falls slightly over time except for the low income group. The absolute gap is constant between low and high income groups and decreases between middle and high income groups. The relative gaps decrease. Improved nutrition may well have played a supporting role in increasing life expectancy.

Table 5
Health Indicators

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Daily Caloric Intake					
1961	98	0.18	2000	2250	3130	11.	15.	8.
1970	101	0.16	2120	2430	3220	8.	16.	7.
1980	102	0.16	2160	2610	3320	9.	15.	7.
1986	102	0.16	2190	2670	3330	11.	15.	6.
			Per Capita Hospital Beds					
1960	95	0.93	.001	.003	.010	97.	59.	24.
1970	99	0.92	.001	.004	.011	79.	69.	22.
1980	49	0.91	-	-	-	-	-	-
			Per Capita Doctors					
1960	97	1.42	.0001	.0004	.0012	106.	86.	22.
1970	102	1.35	.0001	.0005	.0014	88.	92.	18.
1980	49	1.27	-	-	-	-	-	-

Per capita hospital beds and doctors exhibit similar patterns in Table 5. Both increase in proportion or more rapidly with per capita GDP and are not bounded. The coefficient of variation decreases over time only for high and low income groups, and there is little evidence for either that absolute gaps decline. The relative gap declines for both indicators between middle and high income groups. These relations, when compared to life expectancy, suggest that additional doctors and

hospital beds per capita have contributed little to the observed increase in life expectancy.

Education/Literacy Indicators

The major education indicator is the primary school enrollment ratio, which is the proportion of children of elementary school age who are actually enrolled. Other measures which included attendance would be preferable, but are available for very few countries. Direct measures of literacy are also available for relatively few countries, and a distant proxy, daily newspaper circulation per capita, is used instead. The summary statistics for these two indicators are shown in Table 6.

Table 6
Education/Literacy Indicators

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Primary School Enrollment Rate					
1960	97	0.50	40.	81.	110.	68.	30.	12.
1970	95	0.39	54.	90.	104.	52.	24.	10.
1980	101	0.22	72.	98.	102.	44.	18.	5.
			Per Capita Newspaper Circulation					
1960	72	1.96	.010	.058	.331	149.	76.	33.
1970	66	1.74	.014	.069	.333	132.	84.	35.
1979	80	1.51	.013	.069	.357	112.	85.	35.
1985	84	1.61	.016	.074	.347	111.	81.	41.

It is obvious from Table 6 that there is strong convergence of primary school enrollment ratios as per capita GDP rises. Moreover, the reduction in elasticities over time suggests that the degree of convergence has been increasing strongly over the years shown. The coefficient of variation has declined over time

for all income groups, and both absolute and relative gaps have decreased.

The results for daily per capita newspaper circulation suggest that this indicator bears little relation to literacy, but probably is a better measure of the availability of information. Over the years shown this indicator grew faster than per capita GDP and is not bounded. The coefficient of variation decreases over time only for the low income group. There is no reduction in the absolute gap across income groups, but the relative gap decreases.

Urbanization Indicator

Urbanization is often characterized as the handmaiden of development, and the summary statistics shown in Table 7 support this. The percent of the population living in urban areas has become more inelastic with GDP over time, and the coefficient of variation has declined for all income groups over time. Moreover, both the absolute and relative gaps have decreased. It is difficult to give a direct welfare interpretation to

Table 7
Urbanization Indicator

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Population Percent Urban					
1960	101	0.84	12.7	35.3	66.7	59.	48.	22.
1970	106	0.70	16.6	40.9	72.6	52.	41.	17.
1980	108	0.56	21.2	47.2	76.0	46.	36.	15.
1985	108	0.50	24.2	50.3	77.0	45.	33.	15.

urbanization, but we know that it has many positive indirect effects. For example, children in urban areas are more likely to attend school than are children in rural areas. In addition, health care is more readily available in urban areas than rural areas.

Labor Force Indicator

Table 8 shows the summary statistics for labor force participation rates. There is essentially no relation with GDP and no convergence. There is no tendency for the coefficient of variation to decrease over time, although it is markedly smaller for high income countries than for developing countries. The means show rates falling for low income countries while they are rising for middle and high income countries.

Table 9
Labor Force Indicators

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Labor Force Participation Rate					
1960	101	-0.06	46.4	36.1	42.3	18.	21.	9.
1970	104	-0.04	44.5	35.4	42.6	19.	21.	10.
1980	105	-0.00	42.9	36.5	45.3	18.	20.	11.
1985	105	0.02	42.0	39.0	46.5	18.	19.	11.

Examination of labor force participation data suggests that there are measurement inconsistencies with respect to agricultural workers in countries with low incomes. In some countries it appears that household members working on family plots are recorded as members of the labor force while in other countries they are not. This measurement problem may interact

with cultural factors. In Moslem countries, for example, women working in agriculture on family owned plots may not be recorded as being in the labor force.

Consumption Indicators

Three measures of consumption--per capita energy use, per capita telephones, and per capita cars--are shown in Table 9. Each of them increases much more than linearly with per capita

Table 9
Consumption Indicators

Year	No. of Obs.	Elast'y.	Mean Low	Mean Middle	Mean High	Coeff. of Var. Low	Coeff. of Var. Middle	Coeff. of Var. High
			Per Capita Energy Consumption					
1961	95	1.74	58.	511.	2430.	132.	176.	55.
1970	100	1.68	110.	761.	3880.	134.	130.	46.
1980	103	1.54	129.	976.	4490.	127.	105.	46.
1985	103	1.54	116.	983.	4620.	118.	95.	46.
			Per Capita Telephones					
1975	83	1.82	.005	.050	.398	126.	90.	36.
1980	76	1.77	.004	.074	.509	66.	90.	30.
1985	61	1.74	.008	.109	.629	116.	93.	25.
			Per Capita Cars					
1960	96	1.69	.003	.013	.107	131.	110.	75.
1970	102	1.70	.004	.024	.221	116.	108.	37.
1980	91	1.74	.004	.048	.331	76.	92.	24.
1985	58	1.90	-	-	-	-	-	-

GDP. In the case of cars, the relation is becoming more income elastic or divergent over time. The high elasticity of these three items is not surprising because each are tradable goods whose prices do not vary much with per capita GDP.

The coefficient of variation declines over time for energy use and cars per capita, but not for telephones per capita. The absolute gap between income groups does not decrease for any of

the three items; the relative gap between the middle and high income groups declines for telephones and cars.

Central Government Expenditure Indicators

Table 10 shows summary statistics for two categories of central government expenditures, defense and social services. The latter includes expenditures on social security and welfare. For each the expenditures are measured in percent of GNP. The lack of a relation between defense expenditure share and per capita GDP is typical of many other categories of central government expenditure. Social expenditures are the major exception to this pattern and tend to increase more than proportionally with GDP per capita. The growth of social

Table 10
Central Government Expenditure Indicators

Year	No. of Obs.	Elast'y.	Mean			Coeff. of Var.		
			Low	Middle	High	Low	Middle	High
			Defense Expenditures/GNP					
1975	67	0.02	.025	.030	.025	68.	100.	49.
1980	66	0.00	.024	.033	.026	60.	97.	44.
1985	70	0.05	.025	.033	.026	72.	99.	52.
			Social Expenditure/GNP					
1980	65	1.25	.008	.037	.133	147.	94.	40.
1985	65	1.23	.011	.043	.139	113.	101.	34.

expenditures with per capita GDP is strong enough to impart an upward trend in the relation between all government expenditures and per capita GDP. Defense expenditures show no convergence by any measure in Table 10. For social expenditures, the coefficient of variation decrease over time for low and high

income groups, and the relative gap also decreases between these two income groups.

CONCLUSION

In the past three decades, differences in GDP per capita levels across low, middle, and high income countries have increased, and the range of GDP per capita growth rates experienced by developing countries have widened as well.

Table 11 summarizes the three measures of convergence used for GDP level and growth and compares them with similar measures for sixteen social indicators. GDP levels and growth rates show very modest evidence of convergence. Four social indicators--life expectancy, caloric intake, primary enrollment ratios, and urbanization--show evidence of convergence for every measure. The first three of these are fairly direct measures of human welfare. Two social indicators--labor force participation rates and defense expenditures as a proportion of GNP--show no evidence of convergence by any measure used. The remaining ten social indicators show some evidence of convergence, with social expenditures as a percent of GNP being the next most convergent of the remaining indicators.

The "convergence club" of high income countries established in the productivity area clearly extends to social indicators. The convergence counts at the bottom of Table 11 show that the coefficient of variation declines more frequently for the high

Table 11
Summary of Convergence Measures

Indicator	Bounded vs. GDP? (inelastic)	Coeff. of Variatn. Falls for Group? L	M	H	Gap Falls? Absolute L-H	Absolute M-H	Relative L-H	Relative M-H
Productivity								
GDP Level	...	-	+	+	-	-	-	=
GDP Growth	-	-	-	-	-	+	-	-
Social Indicators								
Life Expectancy	+	+	+	+	+	+	+	+
Birth Rate	+	-	-	-	-	+	-	-
Age Depend. Ratio	+	-	-	+	-	+	-	-
Female/Male Ratio	-	+	+	+	-	-	-	-
Caloric Intake	+	-	+	+	=	+	+	+
PC Hosp. Beds	-	+	-	+	-	=	-	+
PC Doctors	-	+	-	+	-	-	-	+
Primary Enrollmt.	+	+	+	+	+	+	+	+
PC Newspapers	-	+	-	-	-	-	+	+
Urbanization	+	+	+	+	+	+	+	+
Lab. Force Part.	-	-	-	-	-	-	-	-
PC Energy	-	+	+	+	-	-	-	-
PC Telephones	-	-	-	+	-	-	-	+
PC Cars	-	+	+	+	-	-	-	+
Defense Exp/GNP	-	-	-	-	-	-	-	-
Soc. Exp/GNP	-	+	-	+	-	-	+	+
Social Indicator Convergence Count	6	10	7	12	3	6	6	10

Key: + is yes; - is no or none; = is unchanged.

income group than for the other two income groups, although its extent of convergence is followed closely by that for the low income group. The middle income group is, however, more likely to close the gap with high income countries than is the low income group. The high and low income groups are becoming more homogeneous over time in terms of their social indicator levels, while the middle income group is becoming more like the high income group. Needless to say, this type of convergence--

increased homogeneity but at low social indicator levels--is not a benign result for low income developing countries.

Some of the convergence in social indicators may be related to the convergence of productivity levels. This linkage may hold for high income countries, but it is insufficient for the low income countries because their productivity levels are not converging. Although social indicator levels are often closely related to GDP levels (witness the regressions in Annex 3), other factors are clearly at work here in addition to GDP levels. The transmission of knowledge, information, and new technology across national boundaries likely plays an important role in the convergence of many social indicators.

Finally, low income developing countries clearly have ample room for improvement in terms of the convergent social indicators that reflect human welfare outcomes. Improvement in these indicators can be obtained by increasing GDP levels in these countries and also by other types of interventions that directly enhance these measures. If the goal of economic development is to promote human welfare, a redoubled effort and focus on low income developing countries is warranted.

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ANNEXES

Annex 1: Countries Included in the Analysis

Heston-Summers GDP Per capita (1985 international prices)

Economy	Type	PCGDP 1960	PCGDP 1970	PCGDP 1980	PCGDP 1985
China	L-EA	723	895	1263	1883
Indonesia	L-EA		803	1430	1704
Haiti	L-LA	921	833	1051	924
Guyana	L-LA	1630	1785	1939	1265
Nepal	L-SA	584	630	686	729
Sri Lanka	L-SA	1389	1438	1584	1962
India	L-SA	617	666	628	696
Pakistan	L-SA	820	1154	1141	1452
Burma	L-SA	341	461	564	659
Bangladesh	L-SA	621	642	671	700
Liberia	L-SS	957	1210	1178	943
Nigeria	L-SS	1133	1237	1555	1066
Burundi	L-SS	473	368	482	539
Mali	L-SS	541	416	511	486
Zaire	L-SS	379	473	349	358
Zambia	L-SS	1172	1311	900	762
Somalia	L-SS	891	685	850	843
Sierra Leone	L-SS	871	1352	1160	1017
Niger	L-SS	604	871	798	625
Sudan	L-SS	975	1035	1077	946
Central Afr Rep	L-SS	806	844	780	699
Mauritania	L-SS	930	1180	1135	926
Ghana	L-SS	1049	1130	995	852
Burkina Faso	L-SS		397	463	510
Kenya	L-SS	635	730	958	845
Tanzania	L-SS	272	379	507	480
Malawi	L-SS	423	536	614	575
Rwanda	L-SS	538	603	699	731
Lesotho	L-SS	346	515	1271	1236
Ethiopia	L-SS	262	315	343	325
Benin	L-SS	1075	1090	1068	1103
Madagaskar	L-SS	1013	1043	862	677
Gambia	L-SS	411	564	682	725
Togo	L-SS	411	672	871	665
Uganda	L-SS	371	402	230	430
Taiwan	M-EA	964	1833	3786	4521
Thailand	M-EA	985	1487	2129	2516
Papua New Guinea	M-EA	1136	2212	1844	1669
Malaysia	M-EA	1783	2441	4427	4751
Korea	M-EA	923	1722	3033	3858
Fiji	M-EA	2354	2815	4023	3517
Philippines	M-EA	1183	1488	2028	1749
Bolivia	M-LA	1142	1578	1835	1566

Annex 1 (continued)

Honduras	M-LA	901	1122	1413	1240
Paraguay	M-LA	1200	1431	2550	2345
Chile	M-LA	3103	3915	4234	3763
Peru	M-LA	2130	2906	3187	2730
Colombia	M-LA	1874	2387	3332	3300
El Salvador	M-LA	1305	1672	1867	1766
Jamaica	M-LA	1829	2936	2468	2381
Brazil	M-LA	1404	2540	4499	3995
Dominican Rep	M-LA	1227	1623	2265	2101
Argentina	M-LA	3381	4366	4614	3982
Panama	M-LA	1533	2579	3442	3655
Guatemala	M-LA	1667	2034	2637	2200
Mexico	M-LA	2870	4061	5758	5332
Venezuela	M-LA	3899	4903	6938	5660
Costa Rica	M-LA	2160	3007	3982	3611
Uruguay	M-LA	4401	4548	5948	4521
Barbados	M-LA	3443	5761	7124	6152
Ecuador	M-LA	1461	1818	3158	2775
Nicaragua	M-LA	1756	2594	2258	1890
Trinidad & Tobago	M-LA	4754	6264	11212	7478
Yemen Arab Rep	M-ME		502	1297	1415
Jordan	M-ME	1328	1600	2548	2731
Cyprus	M-ME	2039	3996	5767	6905
Poland	M-ME			4238	3817
Hungary	M-ME		2988	4989	5170
Yugoslavia	M-ME	1690	2932	4607	4485
Egypt	M-ME	557	795	1522	1932
Algeria	M-ME	1676	1793	3015	3209
Greece	M-ME	1889	3798	5478	5712
Portugal	M-ME	1618	2919	4500	4535
Tunisia	M-ME	1394	1773	2963	3104
Malta	M-ME	1516	2628	4979	5766
Morocco	M-ME	854	1407	1967	2013
Syria	M-ME	1787	2418	5208	5016
Turkey	M-ME	1669	2293	3003	3204
Gabon	M-SS	1373	2695	3883	4210
Cameroon	M-SS	736	1023	1515	1792
Mauritius	M-SS	2113	2129	3469	3756
South Africa	M-SS	2984	4233	4619	4407
Congo	M-SS	1092	1570	1948	2647
Senegal	M-SS	1136	1184	1202	1156
Seychelles	M-SS			3646	3597
Botswana	M-SS	474	863	1881	2555
Cote D' Ivorie	M-SS	1021	1447	1806	1447
Zimbabwe	M-SS	937	1006	1403	1434
Netherland, The	HI	5587	8505	10632	10937
Finland	HI	4718	7259	9970	11225
New Zealand	HI	7222	8581	9189	10138

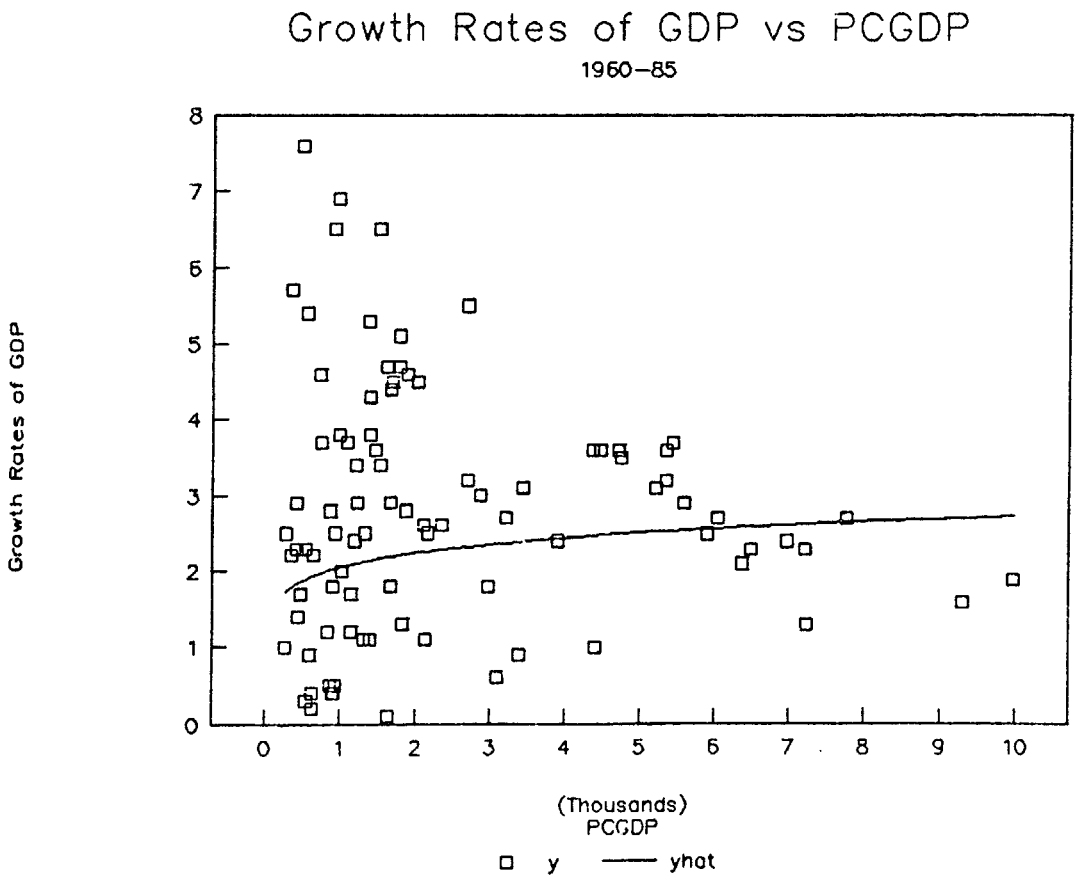
Annex 1 (continued)

Iceland	HI	5352	6991	11833	11900
Canada	HI	7758	10668	13768	15013
France	HI	5344	8536	11148	11376
United States	HI	9983	12923	15310	16779
Belgium	HI	5207	7859	10499	10458
Australia	HI	7204	9978	11715	12550
Sweden	HI	6483	9279	10910	12382
Switzerland	HI	9313	12688	14143	14390
Italy	HI	4375	6937	9986	10584
Germany, Fed Rep	HI	6038	8664	10993	11646
Ireland	HI	3214	4865	6183	6008
Spain	HI	2701	5208	6514	6433
Austria	HI	4476	6781	9616	10291
Luxembourg	HI	6970	8966	11265	12382
Denmark	HI	5900	8556	10322	11980
United Kingdom	HI	6370	8006	9680	10679
Norway	HI	5443	7761	11956	13495
Japan	HI	2701	6688	9615	10781

Annex 2: Regressions and Graph of Growth Rates vs. Initial GDP Per Capita

Growth Rates

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Growth Rates of GDP			
1960-85	91	0.13	0.09	1.35	-0.16	0.02
1960-69	94	0.15	0.10	1.59	-0.20	0.03
1970-79	87	- 0.01	0.08	-0.18	1.10	0.00
1980-85	49	- 0.20	0.12	-1.73	2.17	0.06



Annex 3: Regressions and Graphs of Social Indicators vs. GDP Per Capita

Demographic Indicators

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Life Expectancy			
1960	103	0.21	0.02	13.31	2.40	0.64
1970	107	0.18	0.01	16.20	2.63	0.71
1980	108	0.16	0.01	18.62	2.82	0.77
1985	108	0.15	0.01	19.53	2.93	0.78
			Mortality Rate			
1987	92	-1.01	0.05	-20.58	11.86	0.82
1988	85	-0.98	0.04	-25.89	11.67	0.89
			Birth Rate Per Thousand			
1970	106	-0.38	0.02	-15.24	6.36	0.69
1980	107	-0.41	0.03	-15.95	6.62	0.71
1985	107	-0.44	0.03	-17.32	6.76	0.74
			Age Dependency Ratio			
1960	90	-0.14	0.02	-7.14	0.80	0.37
1970	100	-0.16	0.02	-8.53	0.96	0.43
1980	101	-0.19	0.02	-12.10	1.19	0.60
1985	108	-0.21	0.02	-14.25	1.37	0.66
			Female Male Ratio			
1960	102	-0.001	0.006	-0.10	0.02	0.000
1970	105	0.002	0.004	0.46	0.00	0.002
1980	106	0.006	0.004	1.45	-0.03	0.020
1985	106	0.007	0.004	1.94	-0.04	0.035

Annex 3 (continued)

Health Indicators

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Daily Calorie Intake			
1961	98	0.18	0.01	12.51	6.42	0.62
1970	101	0.16	0.01	13.63	6.59	0.65
1980	102	0.16	0.01	15.11	6.63	0.70
1985	102	0.16	0.01	14.86	6.64	0.69
			Per Capita Hospitals			
1960	95	0.93	0.08	11.93	-12.81	0.60
1970	99	0.92	0.07	13.64	-12.94	0.66
1980	49	0.91	0.10	8.74	-13.19	0.62
			Per Capita Doctors			
1960	97	1.42	0.09	15.09	-18.95	0.71
1970	102	1.35	0.07	19.03	-18.64	0.78
1980	49	1.27	0.10	12.25	-17.98	0.76

Education/Literacy Indicators

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Primary School Enrollment Ratio			
1960	97	0.50	0.06	7.83	0.49	0.39
1970	95	0.39	0.05	7.95	1.28	0.40
1980	101	0.22	0.03	7.07	2.71	0.34
			Per Capita Newspaper Circulation			
1960	72	1.96	0.16	12.46	-18.11	0.69
1970	66	1.74	0.12	14.53	-16.70	0.77
1979	80	1.51	0.10	14.68	-15.17	0.75
1985	84	1.61	0.11	15.26	-16.05	0.72

Annex 3 (continued)

Urbanization Indicators

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Population Percent Urban			
1960	101	0.84	0.06	13.06	-2.98	0.63
1970	106	0.70	0.04	15.51	-1.88	0.70
1980	108	0.56	0.04	15.38	-0.79	0.69
1985	108	0.50	0.04	13.74	-0.20	0.64

Labor Force Indicators

Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
			Labor Force Participation Rate			
1960	101	-0.06	0.02	-2.61	4.14	0.06
1970	104	-0.04	0.02	-1.73	3.95	0.03
1980	105	-0.00	0.02	-0.06	3.69	0.00
1985	105	0.02	0.02	1.27	3.49	0.02

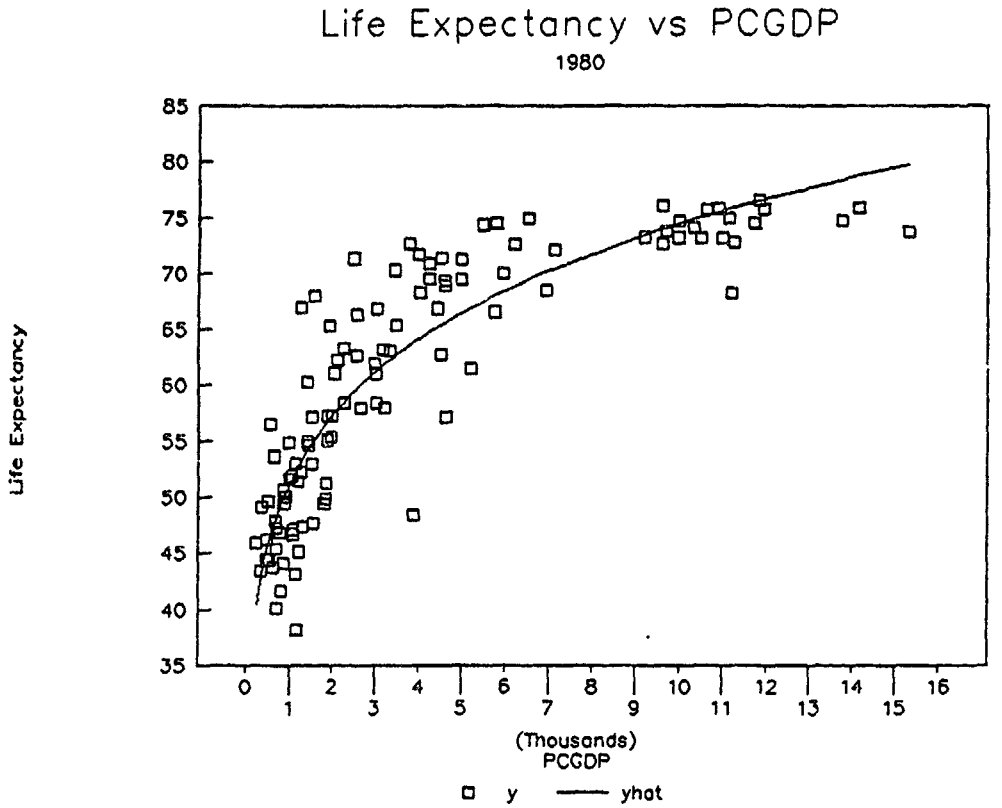
Annex 3 (continued)

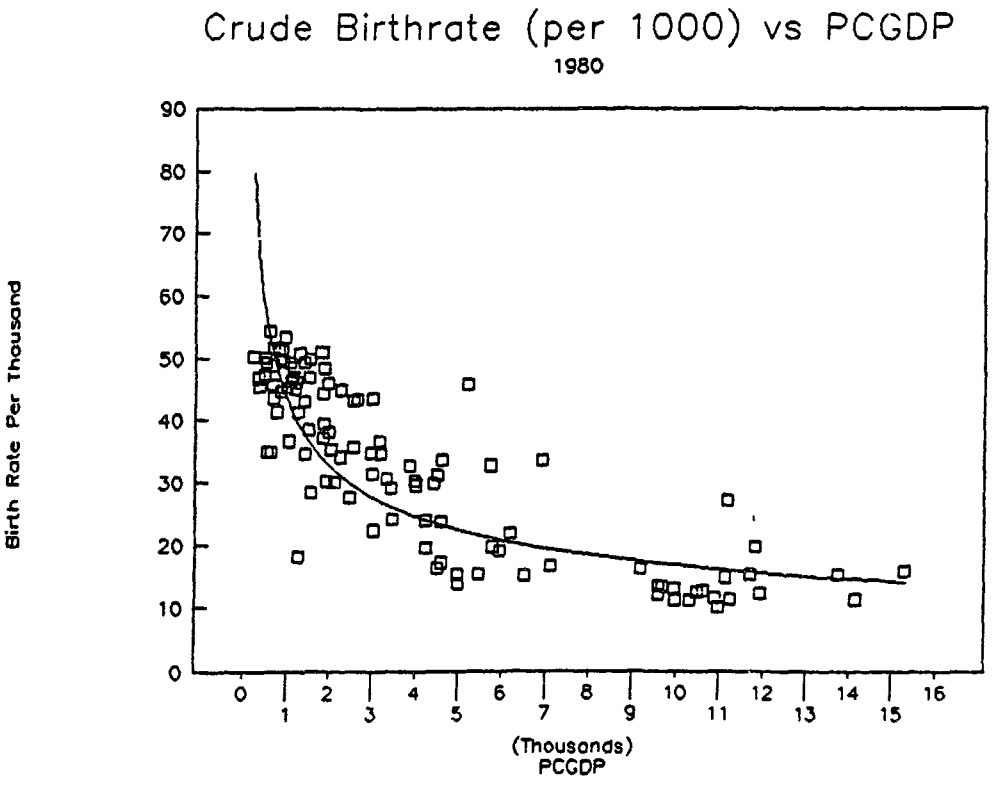
Consumption Indicators

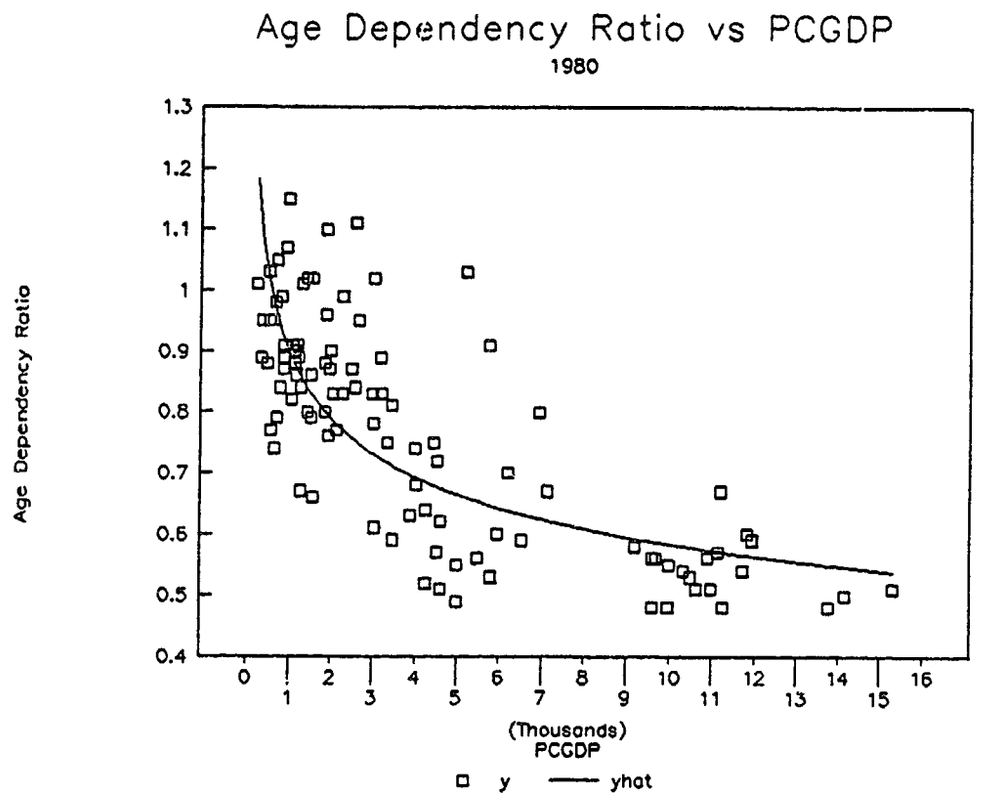
Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
		Per Capita Energy Consumption				
1961	95	1.74	0.11	16.23	-7.54	0.74
1970	100	1.68	0.07	22.59	-6.98	0.84
1980	103	1.54	0.06	26.85	-5.93	0.88
1985	103	1.54	0.05	29.92	-5.94	0.90
		Per Capita Telephones				
1975	83	1.82	0.06	28.96	-17.78	0.92
1980	76	1.77	0.07	26.09	-17.34	0.90
1985	61	1.74	0.08	20.79	-16.79	0.88
		Per Capita Cars				
1960	96	1.69	0.11	15.23	-17.32	0.71
1970	102	1.70	0.07	24.24	-17.14	0.85
1980	91	1.74	0.07	23.71	-17 47	0.86
1985	58	1.90	0.10	19.41	-18.76	0.87

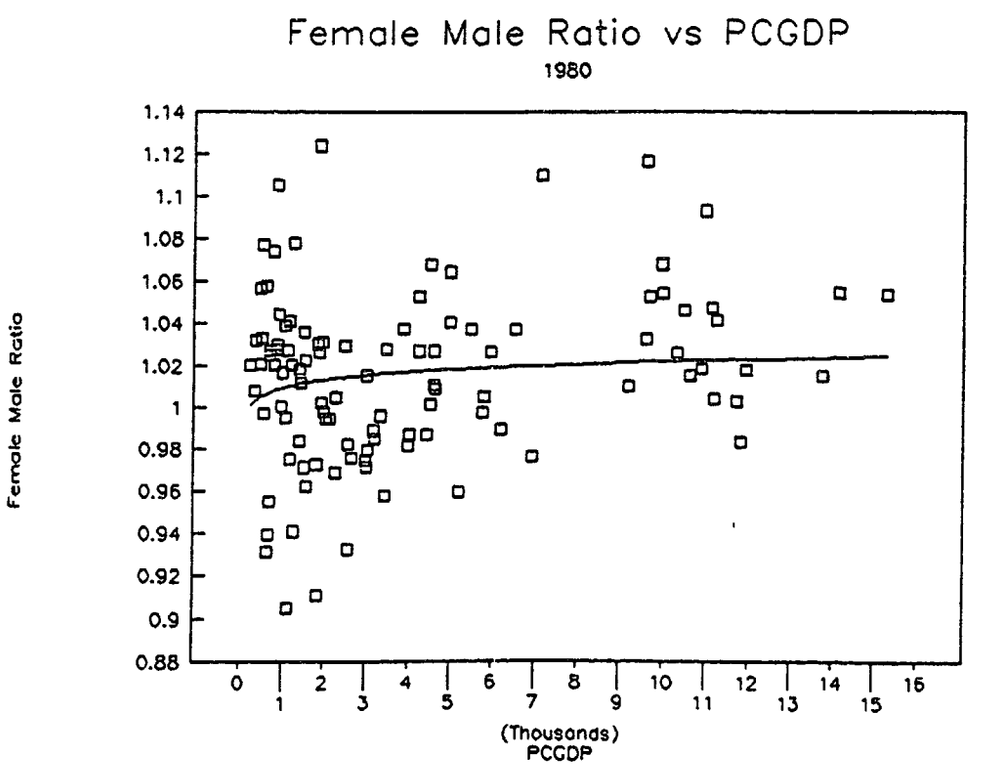
Central Government Expenditure Indicators

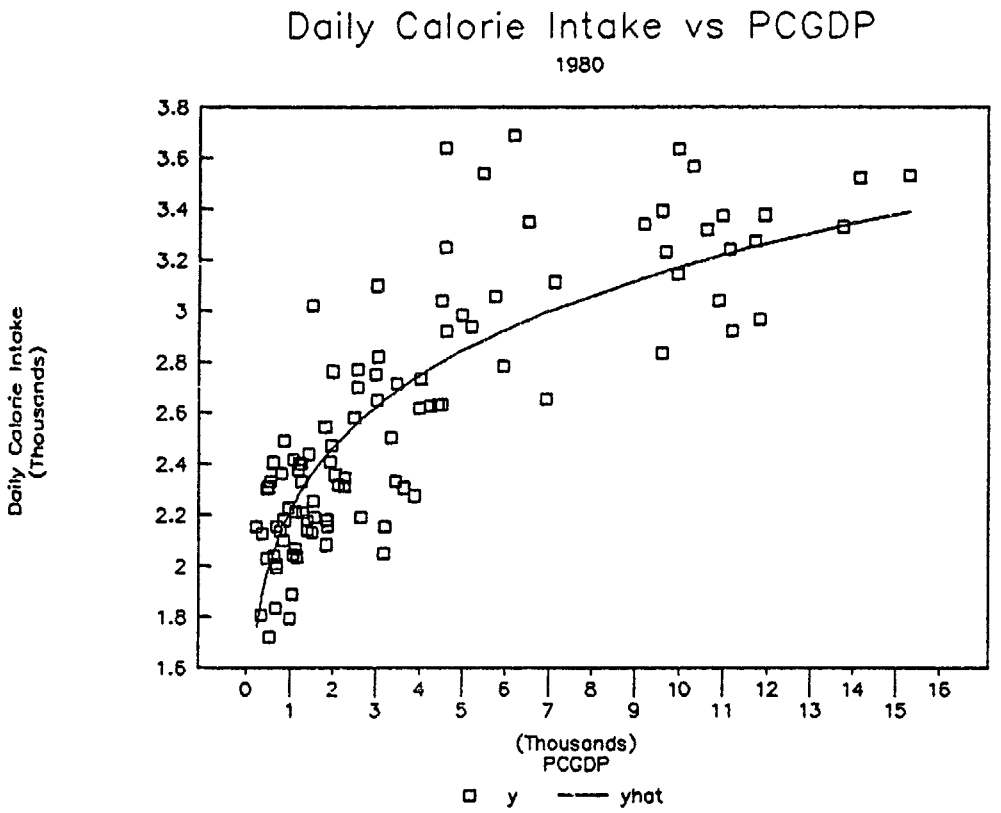
Year	No. of countries	Elasticity	Std. error of elasticity	T ratio	Intercept	R sqr
		Defense Expenditures/GNP				
1975	67	0.02	0.12	0.14	-4.07	0.00
1980	66	0.00	0.10	0.03	-3.87	0.00
1985	70	0.05	0.09	0.54	-4.22	0.00
		Social Expenditures/GNP				
1980	65	1.25	0.13	9.75	-13.91	0.60
1985	65	1.23	0.27	4.59	-13.13	0.25

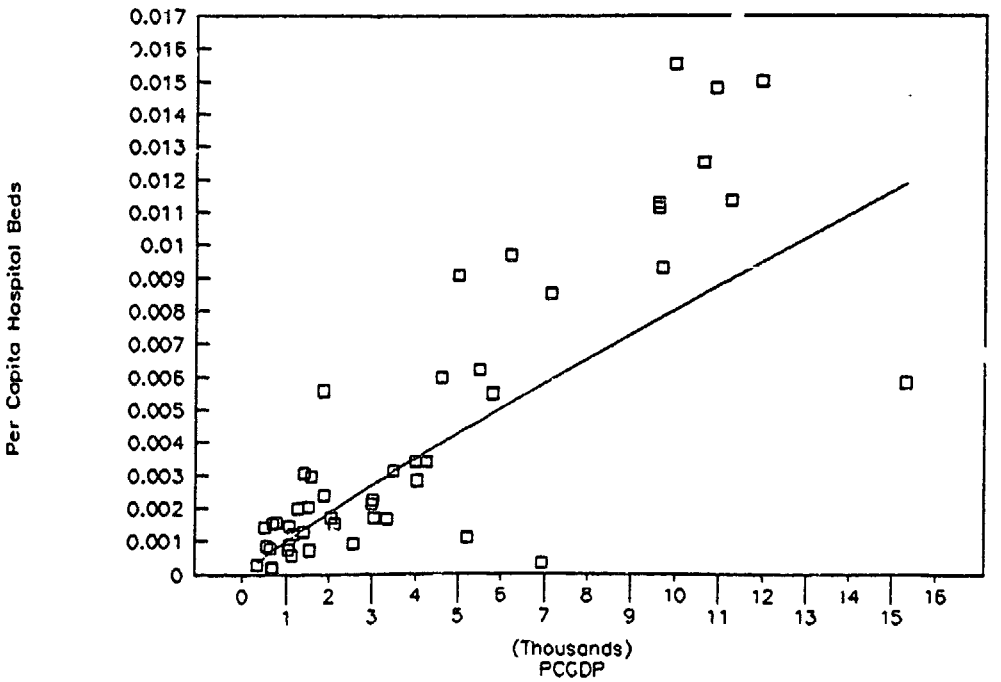

Life Expectancy vs PCGDP
1980
Life Expectancy
85
80
75
70
65
60
55
50
45
40
35
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP
y
yhat

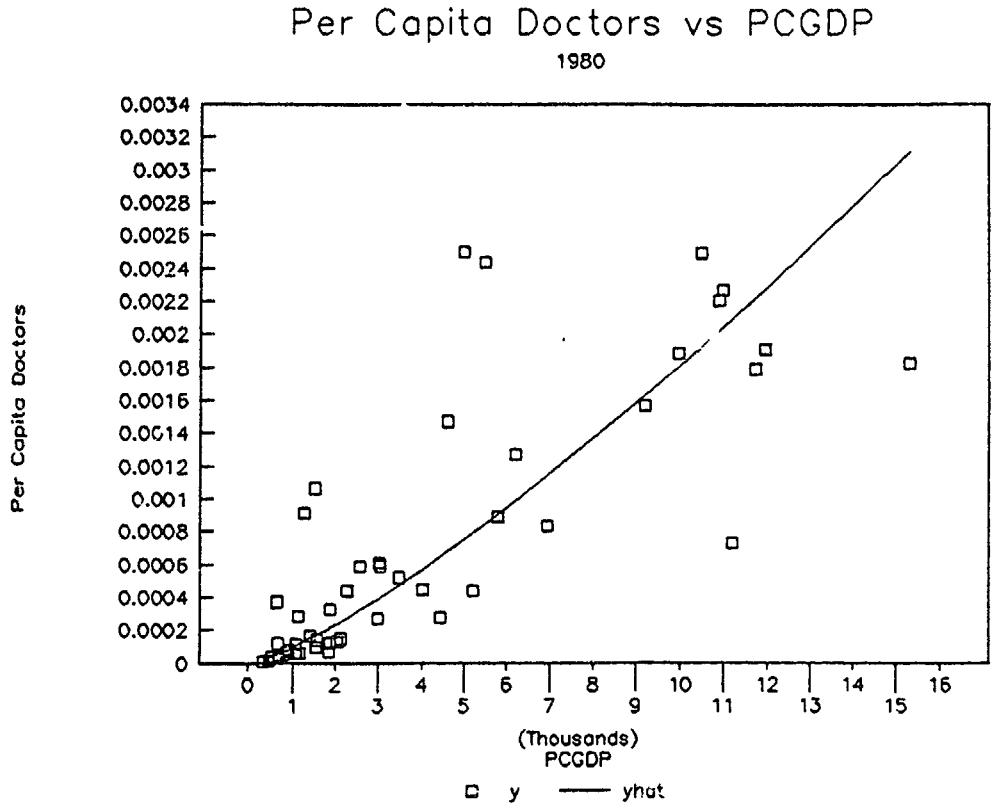

Crude Birthrate (per 1000) vs PCGDP
1980
Birth Rate Per Thousand
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP

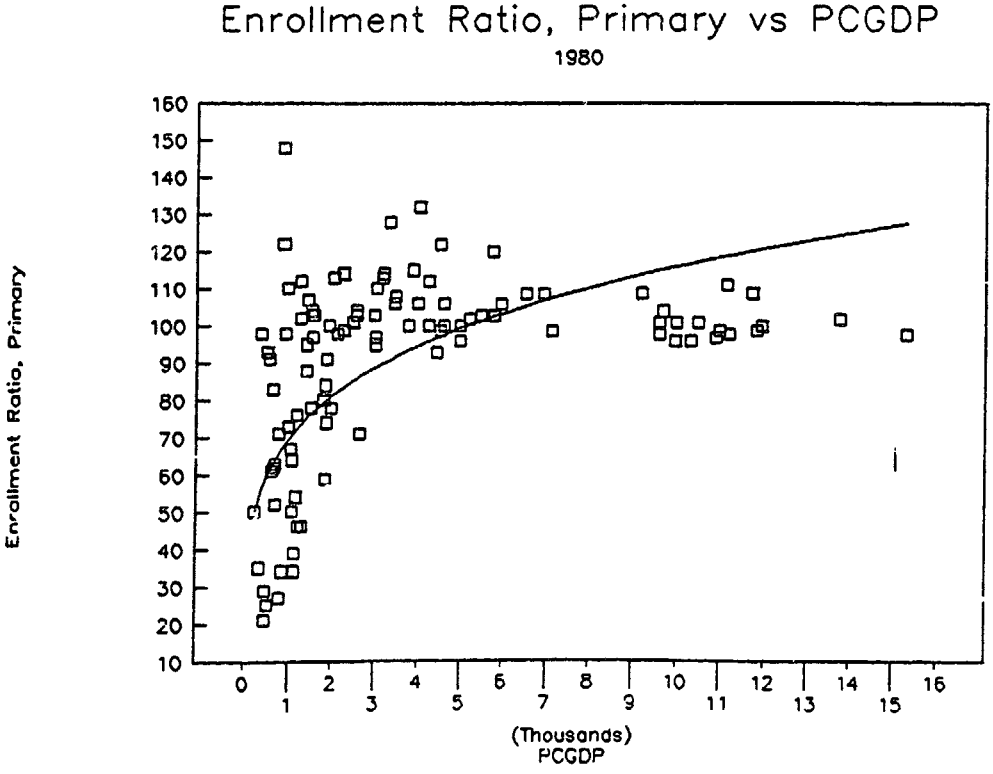

Age Dependency Ratio vs PCGDP
1980
Age Dependency Ratio
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP
y
yhat

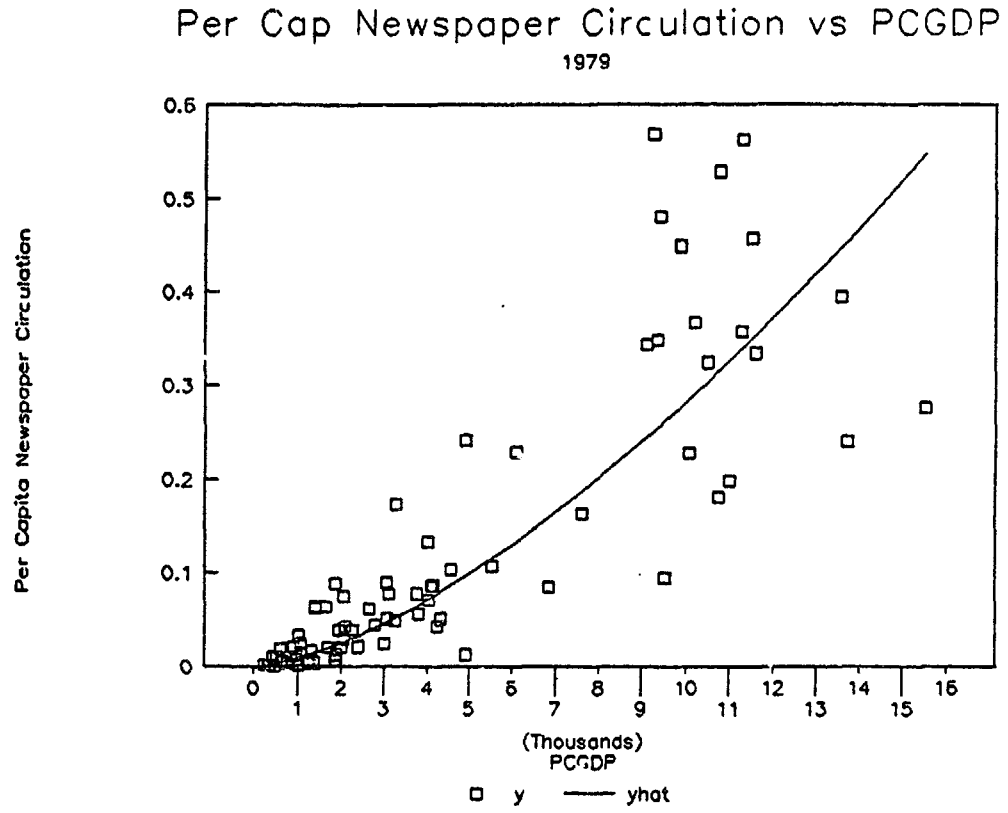

Female Male Ratio vs PCGDP
1980
Female Male Ratio
1.14
1.12
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP

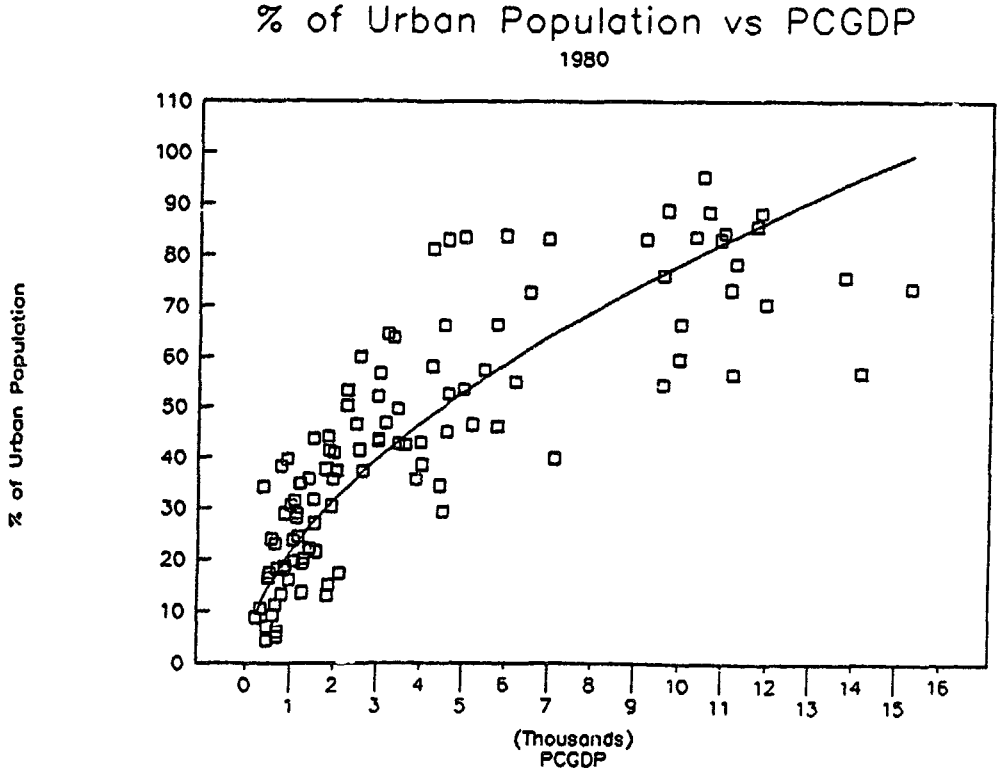

Daily Calorie Intake vs PCGDP
1980
Daily Calorie Intake (Thousands)
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands) PCGDP
y
yhat


Per Capita Hospital Beds vs PCGDP
1980
Per Capita Hospital Beds
0.017
0.016
0.015
0.014
0.013
0.012
0.011
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands) PCGDP


Per Capita Doctors vs PCGDP
1980
Per Capita Doctors
0.0034
0.0032
0.003
0.0028
0.0026
0.0024
0.0022
0.002
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP
y
yhat

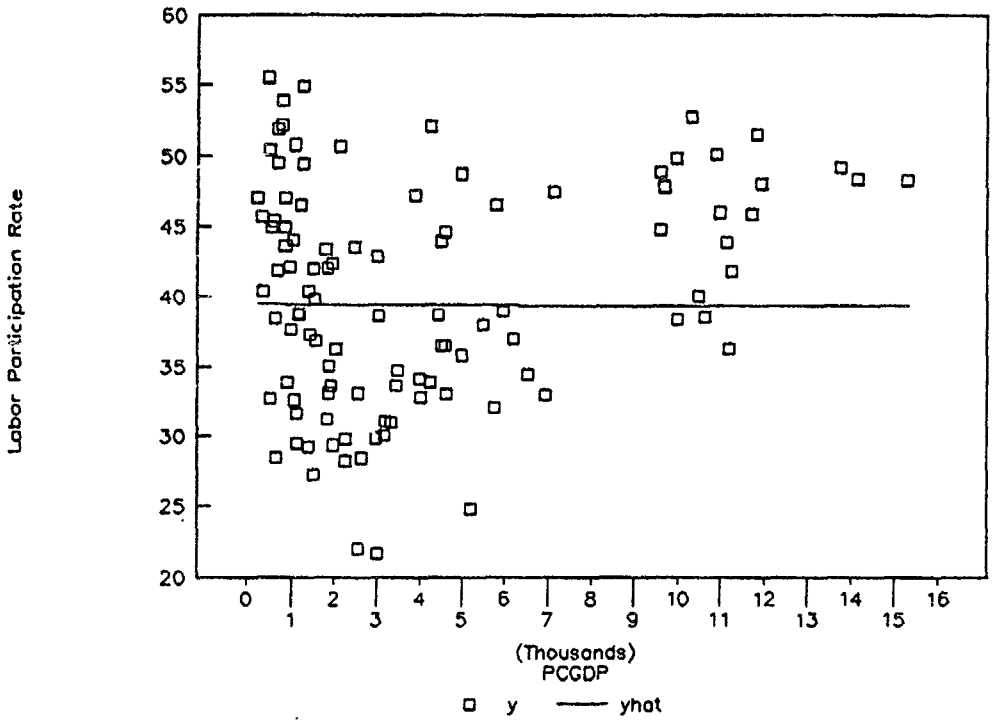

Enrollment Ratio, Primary vs PCGDP
1980
Enrollment Ratio, Primary
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP


Per Cap Newspaper Circulation vs PCGDP
1979
Per Capita Newspaper Circulation
0.6
0.5
0.4
0.3
0.2
0.1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP
y
yhat


% of Urban Population vs PCGDP
1980
% of Urban Population
110
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP

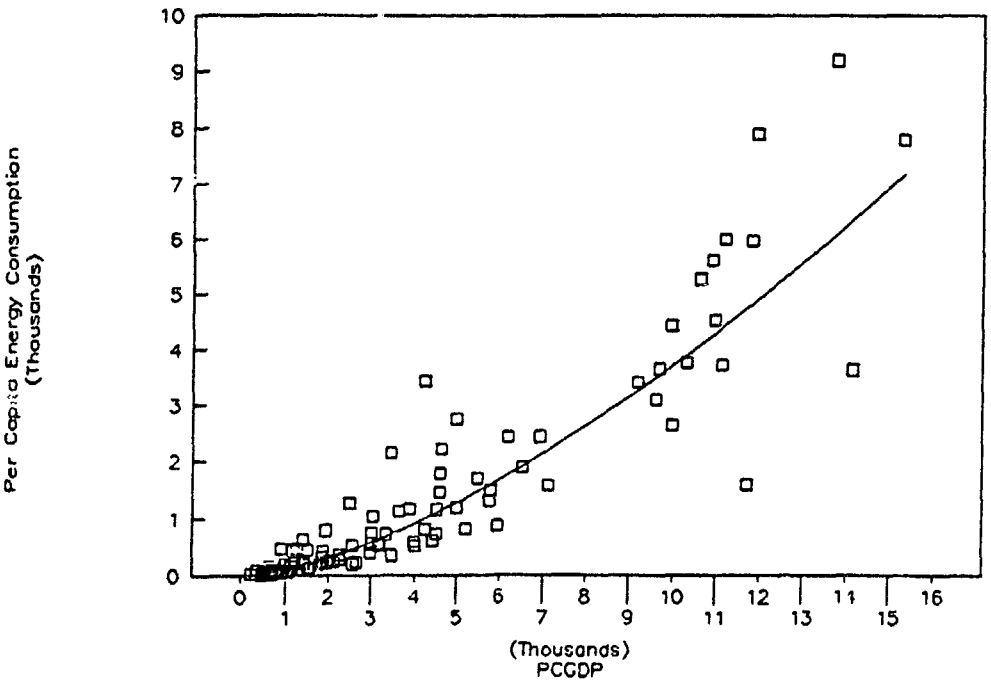
Labor Participation Rate vs PCGDP

1980



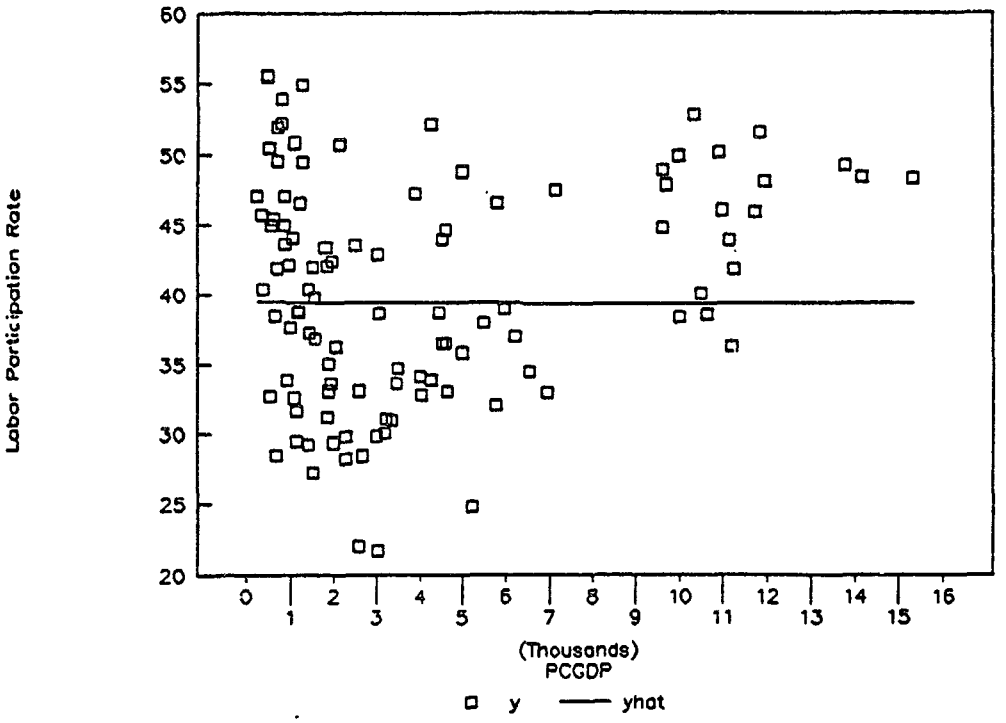
Per Capita Energy Consumption vs PCGDP

1980



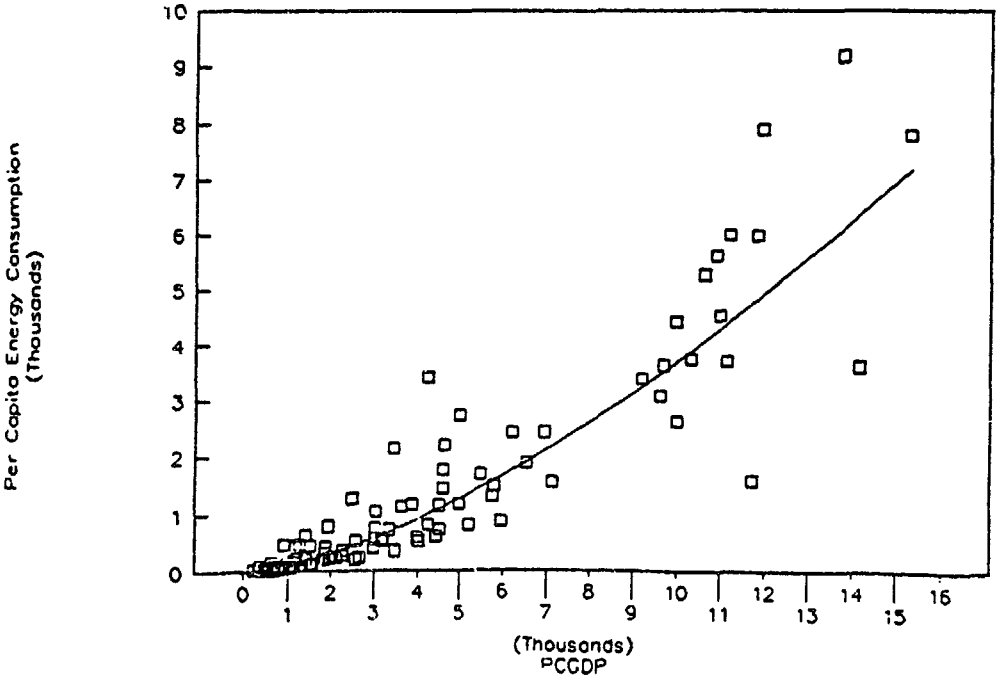
Labor Participation Rate vs PCGDP

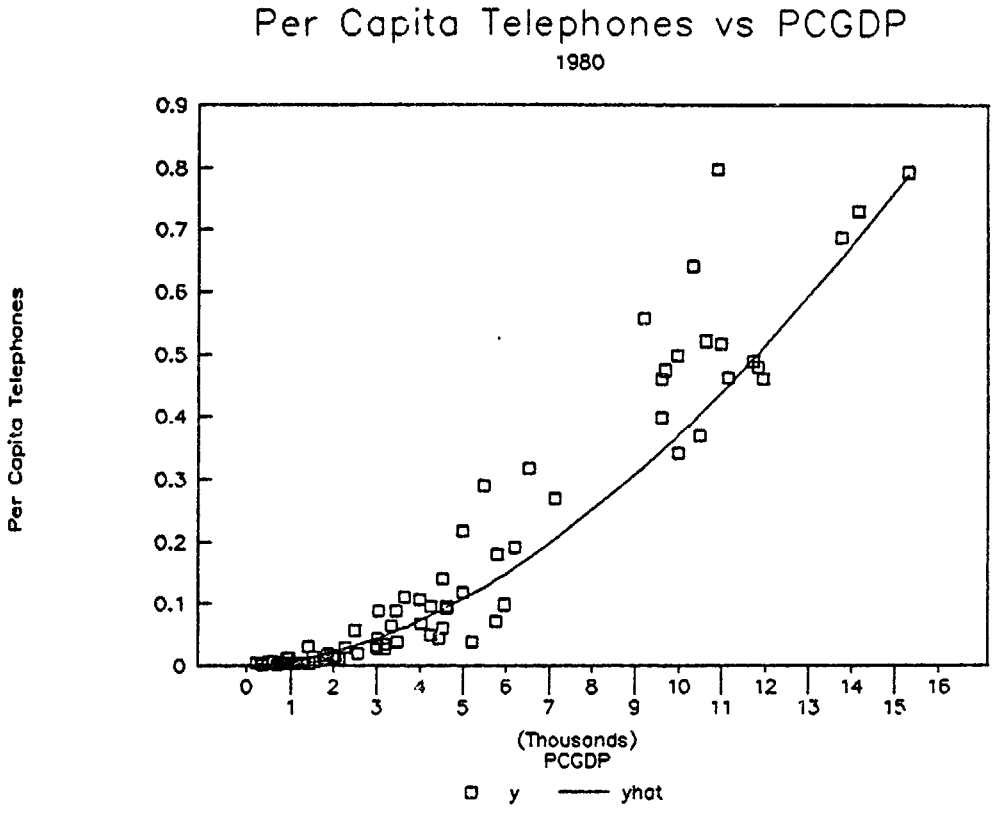
1980

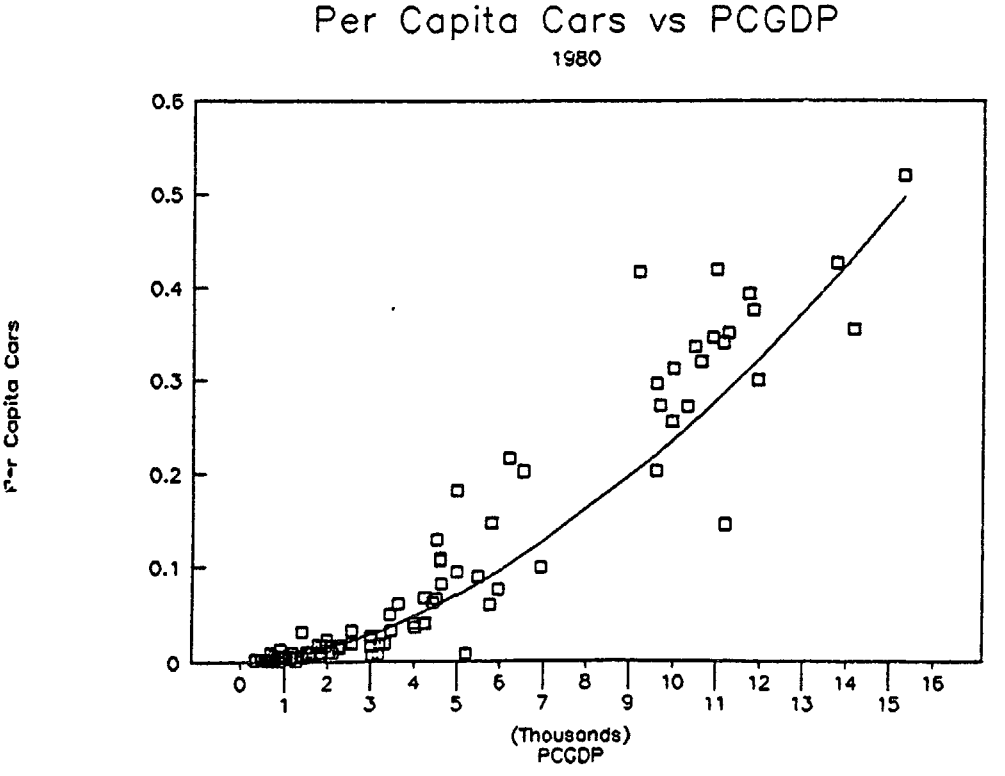


Per Capita Energy Consumption vs PCGDP

1980

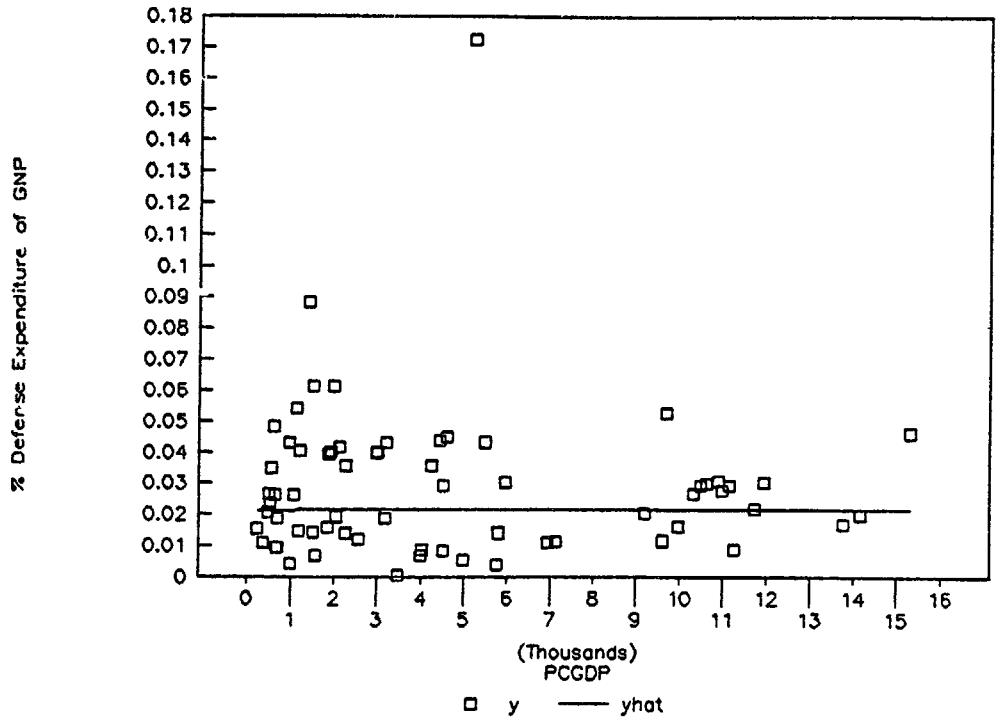



Per Capita Telephones vs PCGDP
1980
Per Capita Telephones
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP
y
yhat


Per Capita Cars vs PCGDP
1980
Per Capita Cars
0.6
0.5
0.4
0.3
0.2
0.1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Thousands)
PCGDP

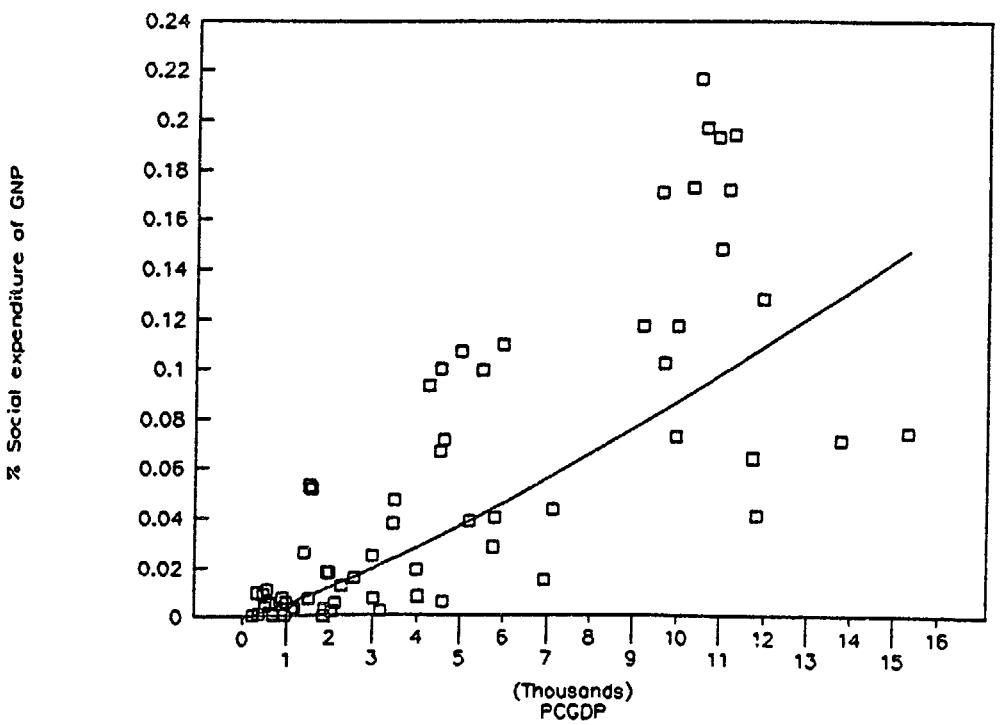
% Defense Expenditure of GNP vs PCGDP

1980



% Social Expenditure of GNP vs PCGDP

1980



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